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BRIEFER ARTICLES.

NEREOCYSTIS LUETKEANA.

(WITH ONE FIGURE)

This giant kelp is one of the most common, and certainly one of the most striking algae of the shores of northwest America. Its cylindrical, hollow stalks, as much as 21^m long, gradually widening from a diameter of 1^{cm} below to 10^{cm} above, surmounted by a bulb as much as 20^{cm} in diameter and provided with a crown of leaf-like fronds 3-9^m long; its habitat on submerged rocks over which it forms brown patches acres in extent, a warning to fishermen and pilots, and so dense that only with great difficulty can one get a rowboat through them; its presence everywhere in still waters and stranded along shores, torn loose and transported by waves and wind, attract the attention of every casual traveler along north Pacific shores. Two things concerning this plant at once impress the botanist, viz.: its remarkably rapid growth and its manner of solving the problems of life.

1. *Growth*.—We have here a plant 15-21^m long,¹ reported to reach a length of over 90^m,² but probably erroneously; MACMILLAN³ mentions 80 feet. HARVEY⁴ states that it is growing at all seasons; fishermen and pilots, however, say that it disappears in winter. I knew the June condition of these plants, and I had accurately located several beds of them near the Marine Station of the University of Washington at Friday Harbor, Wash., during the summers of 1904 and 1905. On March 10, 1906, I made another trip to these beds with a view to determining whether or not this gigantic plant is an annual. The fishermen are partly right. Except for stragglers here and there, the kelps are gone; while those remaining were nearly all decayed and loose, with their fronds mostly torn away. Where the plants were floating freely, the remaining ones were yet in fair condition as to decay, as salt water prevents rapid bacterial action; but it required considerable searching to find a dozen good specimens.

Drifting over the reefs one can see, through a glass-bottomed bucket, on the bottom 3 to 9^m below, young plants of *Nereocystis* 1.25 to 2.5^m

¹ SAUNDERS, Algae of Harriman Alaska Expedition. Proc. Wash. Acad. Sci. 3:431.

² ENGLER & PRANTL, Die natürlichen Pflanzenfamilien 12:259.

³ Bull. Torr. Bot. Club 26:273-299. 1899.

⁴ Sea mosses 87.

long, with bulbs 12 to 38^{mm} in diameter, and fronds 30 to 90^{cm} long. It seems that they do not reach the surface the first year, but remain out of reach of waves, pushing rapidly up in the second season only to die when winter overtakes them. A growth of about 18^m in the second year, between the middle of March and the first of June, a period of about 70 days, requires on the average a growth of over 25^{cm} a day. The probability is that it is even greater, for March is cool on Puget Sound, so the growth would occur chiefly in the latter part of this period. In proof of this



FIG. 1.—*Nereocystis Luetkeana*.

belief is the fact that the ground was frozen during the whole week succeeding the time of observation; in fact, it was the coldest weather of the whole winter. Then too, another trip on May 10, 1906, but to a different bed, revealed none over 6^m long; so it is evident that they had 9 to 15^m of stretching before them for the next month. Twenty-five centimeters per day is about 0.175^{mm} per minute, which is between one-third and one-fourth as rapid as that reported for the bamboo,⁵ and far above that of ordinary plants. One hardly expects prolonged rapid growth in the latitude of Puget Sound, but *Nereocystis* certainly furnishes an example of it.

⁵ STRASBURGER *et. al.*, A text book of botany, English edition, 231. 1903.

2. *Life relation.*—The shore just below low tide to a depth of 6^m is taken up by shorter, broad algae, mostly brown, many green, a few red; limited up shore by the grinding wave-washed rocks as the tide level varies, and by the baking heat of a summer sun during low spring-tides; limited downwards by the decreasing sunlight; we find on this strip the battle ground of the green and brown algae, species against species. *Nereocystis*, with its tough, flexible, cattle-whip-like stalk 12 to 21^m long, rises from the bottom in the deeper waters, a veritable Esau, surrendering to the Jacobs the coveted strip and wresting from the undesired, comparatively unoccupied territory beyond, a highly successful existence. The stalk is firmly anchored to the rocks below by holdfasts covering an area as much as 30^{cm} in diameter. So strong and tough is the stalk, and so firm the attachment, that often a pull of several hundred pounds is necessary to loosen the plant; and then the stalk more often than the holdfast gives way; but a large plant, avoiding quiet waters, needs a firm hold, and one occasionally finds the plants washed ashore with holdfasts dragging rocks as much as 20^{cm} in diameter. The admonition to "build upon a rock" holds for *Nereocystis*, and the rock must be a big one; those which "build upon sand" are washed away before they reach the adult stage. This is one of the reasons why it grows upon reefs.

Algae love moving water, but few can afford it. Moving water facilitates gas exchange by carrying away that laden with evolved and lacking in desired gases, and by not depositing suspended materials like quiet water. A layer of beach washings over a plant absorbs sunlight, one of the scarcer commodities of marine algae, any diminution of which only those most favorably located can afford. *Nereocystis*, by its firm anchorage and long stalks, surmounted by a bunch of tough blades 3 to 9^m long but narrow for their length, rides easily in flowing water, and chooses for its home the rocky, clean-swept, tide-washed promontories, where the current keeps its blades horizontal.

Below 6^m the brown algae rapidly decrease, and dredging in Puget Sound shows that below 12^m they are exceptional. They need light. It is well known too, that the decrease in light downward in water is rapid. This makes the surface the most desirable location. But shore forms, at the surface at high tide, are stranded high and dry at low tide; and those at the surface at low tide are covered at high tide, the depth depending upon the difference between high and low tide. This constant change in water level is one of the greatest difficulties with which seaweeds have to contend. We see at once that marine algae have a very serious problem, to steer clear of the Scylla of darkness on the one hand, and, on the other,

at a very short bow-shot's distance, the Charybdis of tide-line destruction by wave and sun. *Nereocystis* has solved the problem by the floating dock. Its holdfast at the smaller end of the stalk serves as the anchor, fastened far enough off shore to prevent stranding at low tide; its hollow bulb, surmounting the larger, hollow end of the stalk is the float; attached to the bulb are the leaves, constantly at the surface, supple, tough, safe in storm, current, and varying tide. However, it has minor troubles, since in creating for its own fronds an excellent environment it has created also an excellent habitat for other forms as well. It is not uncommon to see the bulbs and stalks densely covered with delicate red and green algae, and hydroids and bryozoa. Rising from unoccupied territory, and creating for its fronds one of the best habitats among marine algae, *Nereocystis Luetkeana* challenges the respect of the botanist and the lover of nature.—THEODORE C. FRYE, *State University, Seattle, Washington*.

TWO NEW SPECIES FROM NORTHWESTERN AMERICA.

MISS EDITH M. FARR of Philadelphia has recently submitted to the writer a small collection of plants for identification. The collection was made in the mountainous regions of Alberta and British Columbia, chiefly in the vicinity of Banff, Lake Louise, Field, etc., during the summers of 1904 and 1905. Among other interesting rarities there are two which the writer has been unable to place satisfactorily in any described species. These are characterized as follows:

Castilleja purpurascens Greenman, n. sp.—Perennial, more or less purplish throughout: stems erect or nearly so, 1 to 3^{dm} high, usually several from a multicapital caudex, glabrous or puberulent below, villous above: leaves sessile, subamplexicaul, linear to narrowly lanceolate, 1.5 to 4.5^{cm} long, 1 to 7^{mm} broad, usually attenuate and acute, entire and undivided or occasionally 3-cleft near the apex, glabrous or the upper somewhat villous-pubescent, 3-nerved; the lowermost leaves much reduced: inflorescence terminating the stem in a subcapitate raceme, later elongating to about 7^{cm} in length, villous-pubescent; bracts ovate-lanceolate to oblong-ovate, 2 to 2.5^{cm} long, usually entire, occasionally cleft: calyx 1.5 to 2.5^{cm} long, and as well as the bracts varying in color from a deep purplish-red to scarlet and rarely to yellow tinged with red or pink, about equally divided before and behind, externally villous with glandular hairs intermixed; the lateral divisions 2-lobed, lobes obtuse: corolla 2 to 3^{cm} long; galea about one-half as long as the corolla-tube, green or greenish-yellow on the glandular puberulent back, with scarlet or magenta colored